

Citation:

Flood A, Velie EM, Sinha R, Chatterjee N, Lacey JV Jr, Schairer C, Schatzkin A. Meat, fat, and their subtypes as risk factors for colorectal cancer in a prospective cohort of women. *Am J Epidemiol.* 2003;158(1):59-68.

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Study Design:

Prospective Cohort Study

Class:

B - [Click here](#) for explanation of classification scheme.

Research Design and Implementation Rating:

POSITIVE: See Research Design and Implementation Criteria Checklist below.

Research Purpose:

This study examines the association of prospectively measured dietary meat and fat intake, and various subtypes of each, with colorectal cancer in a large cohort of women.

Inclusion Criteria:

- Women enrolled in the Breast Cancer Detection Demonstration Project (BCDDP) between 1973 and 1980.
- Completed the baseline questionnaire at follow-up.
- Subsequently completed mailed questionnaires during three separate follow-up periods.

Exclusion Criteria:

Women who

- did not complete a questionnaire at the first follow-up state.
- had a diagnosis of colorectal cancer at the first follow-up or earlier.
- reported entry date occurred after their exit date.
- skipped more than 30 items on their food frequency questionnaires.
- reported total energy intake above 3,800 or below 400 kcal per day.
- had unusually high intakes of meat (exceeding 9 times per day)

Description of Study Protocol:**Recruitment**

A cohort of women from the Breast Cancer Detection Demonstration Project (BCDDP) conducted under the joint sponsorship of the National Cancer Institute and the American Cancer

Society.

Design

Women in the cohort completed a food frequency questionnaire. Colorectal cancer incident cases were reported within this cohort.

Statistical Analysis

Cox proportional hazards regression (PROC PHREG in SAS version 6.12 software) with age as the underlying time metric to generate rate ratios and 95 percent confidence intervals for dietary fat and meat consumption both separately and in combination. All p values were two sided. To test for trend, grams of meat or percentage of energy from fat were entered into the model as continuous terms and reported the p value associated with the estimated beta coefficient.

Both meat and fat consumption for energy using the multivariate nutrient density method.

Additional variables were considered for inclusion into the models as potential confounders, including smoking (ever/never), education (through high school/more than high school), body mass index (weight (kg)/height (m)²), height, weekday physical activity index expressed in units of metabolic equivalent time, alcohol, folate, vitamin D, calcium, fiber, fruits, vegetables, grains, and nonsteroidal antiinflammatory drug use (yes/no). None of these factors generated any material changes in either the meat or fat model.

Data Collection Summary:

Timing of Measurements

Three separate follow-up periods: 1987-1989, 1992-1995, and 1995-1998

Dependent Variables

- Colorectal case ascertainment: self-reports on 1992-1995 and 1995-1998 questionnaires; state-wide cancer registries, and the National Death Index (through 1997); pathology reports of confirmed cases of adenocarcinoma of the colon or rectum

Independent Variables

- Dietary assessment: 62-item National Cancer Institute/ Block food frequency questionnaire to assess usual dietary intake over the previous year.
 - total meat
 - total fat

Control Variables

Energy-adjusted models for total meat and total fat

Description of Actual Data Sample:

Initial N: 64,182 women

Attrition (final N): 45,496 in final analytic cohort

Descriptive characteristics of the analytic cohort, Breast Cancer Detection Demonstration

Project Follow-up Cohort, 1987-1998

	% distribution
Age (years) at entry to cohort	
<50	4.6
50-59	40.2
60-69	38.8
70-79	14.1
≥80	2.3
Ethnicity	
Caucasian	88.8
African American	3.6
Asian	4.8
Hispanic	1.9
Other/unknown	0.9
Place of residence in the United States by region	
Northeast	15.2
Southeast	22.9
Midwest	28.4
Mountain States	4.1
Southwest	7.5
Pacific	21.8
Maximum educational attainment	
less than high school	10.8
High school graduate	42.1
Some college	23.9

College graduate	12.4
Postcollegiate study	9.9

Summary of Results:

Key Findings

- Relative risks for increasing quintiles of total meat and red meat consumption indicated no association with colorectal cancer (relative risk for high compared with low quintile = 1.10, 95%CI: 0.83,1.45) for red meat.
- For total fat, there was no association with increasing quintiles of consumption (relative risk for high compared with low quintile = 1.14, 95% confidence interval: 0.86, 1.53).
- None of the other subtypes of either meat or fat showed any association with colorectal cancer.

Relative risk fo colorectal cancer cross-classifying by level of total meat and total fat Intakes

	Meat Quintile 1	Meat Quintiles 2-4	Meat Quintile 5
Fat Quintile 1 No.	2,903 (31)*	5,016 (56)	1,177 (8)
RR	1.0	1.12	0.74
95%CI	Referent	0.72,1.74	0.34, 1.61
Fat Quintiles 2-4 No.	4,926 (61)	16,718 (164)	5,660 (72)
RR	1.20	1.04	1.43
95% CI	0.78, 1.85	0.71, 1.52	0.93, 2.17
Fat Quintile 5 No.	1,270 (20)	5,564 (55)	2,262 (20)
RR	1.60	1.14	1.05
95% CI	0.91, 2.80	0.73, 1.77	0.60, 1.84

*indicates number of cases

Author Conclusion:

This study provided no evidence of an association between either meat or fat (or any subtypes) and colorectal cancer incidence. The authors cannot rule out the possibility of a modest association.

Reviewer Comments:

The analyses did not adjust family history of CRC or multiple comparisons.

Research Design and Implementation Criteria Checklist: Primary Research

Relevance Questions		
1.	Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (Not Applicable for some epidemiological studies)	Yes
2.	Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	Yes
3.	Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to nutrition or dietetics practice?	Yes
4.	Is the intervention or procedure feasible? (NA for some epidemiological studies)	Yes
Validity Questions		
1.	Was the research question clearly stated?	Yes
1.1.	Was (were) the specific intervention(s) or procedure(s) [independent variable(s)] identified?	Yes
1.2.	Was (were) the outcome(s) [dependent variable(s)] clearly indicated?	Yes
1.3.	Were the target population and setting specified?	Yes
2.	Was the selection of study subjects/patients free from bias?	Yes
2.1.	Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	Yes
2.2.	Were criteria applied equally to all study groups?	Yes
2.3.	Were health, demographics, and other characteristics of subjects described?	Yes
2.4.	Were the subjects/patients a representative sample of the relevant population?	Yes
3.	Were study groups comparable?	Yes
3.1.	Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	N/A
3.2.	Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	N/A
3.3.	Were concurrent controls used? (Concurrent preferred over historical controls.)	N/A

3.4.	If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	Yes
3.5.	If case control or cross-sectional study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	N/A
3.6.	If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	N/A
4.	Was method of handling withdrawals described?	Yes
4.1.	Were follow-up methods described and the same for all groups?	Yes
4.2.	Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	Yes
4.3.	Were all enrolled subjects/patients (in the original sample) accounted for?	Yes
4.4.	Were reasons for withdrawals similar across groups?	N/A
4.5.	If diagnostic test, was decision to perform reference test not dependent on results of test under study?	N/A
5.	Was blinding used to prevent introduction of bias?	N/A
5.1.	In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	N/A
5.2.	Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	N/A
5.3.	In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	N/A
5.4.	In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	N/A
5.5.	In diagnostic study, were test results blinded to patient history and other test results?	N/A
6.	Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were intervening factors described?	N/A
6.1.	In RCT or other intervention trial, were protocols described for all regimens studied?	N/A
6.2.	In observational study, were interventions, study settings, and clinicians/provider described?	N/A

6.3.	Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	N/A
6.4.	Was the amount of exposure and, if relevant, subject/patient compliance measured?	N/A
6.5.	Were co-interventions (e.g., ancillary treatments, other therapies) described?	N/A
6.6.	Were extra or unplanned treatments described?	N/A
6.7.	Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	N/A
6.8.	In diagnostic study, were details of test administration and replication sufficient?	N/A
7.	Were outcomes clearly defined and the measurements valid and reliable?	Yes
7.1.	Were primary and secondary endpoints described and relevant to the question?	Yes
7.2.	Were nutrition measures appropriate to question and outcomes of concern?	Yes
7.3.	Was the period of follow-up long enough for important outcome(s) to occur?	Yes
7.4.	Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	Yes
7.5.	Was the measurement of effect at an appropriate level of precision?	Yes
7.6.	Were other factors accounted for (measured) that could affect outcomes?	Yes
7.7.	Were the measurements conducted consistently across groups?	Yes
8.	Was the statistical analysis appropriate for the study design and type of outcome indicators?	Yes
8.1.	Were statistical analyses adequately described and the results reported appropriately?	Yes
8.2.	Were correct statistical tests used and assumptions of test not violated?	Yes
8.3.	Were statistics reported with levels of significance and/or confidence intervals?	Yes
8.4.	Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	N/A
8.5.	Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	???
8.6.	Was clinical significance as well as statistical significance reported?	Yes

8.7.	If negative findings, was a power calculation reported to address type 2 error?	Yes
9.	Are conclusions supported by results with biases and limitations taken into consideration?	Yes
9.1.	Is there a discussion of findings?	Yes
9.2.	Are biases and study limitations identified and discussed?	Yes
10.	Is bias due to study's funding or sponsorship unlikely?	Yes
10.1.	Were sources of funding and investigators' affiliations described?	Yes
10.2.	Was the study free from apparent conflict of interest?	Yes

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